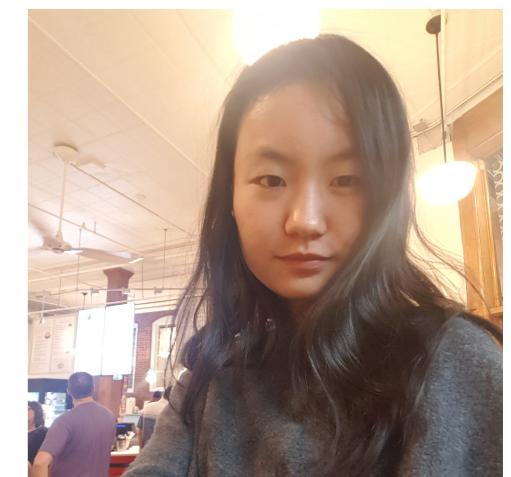


# Research Exchange - A Collaborative Paper Annotation Tool



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*30th April, 2019*

<http://researchexchange.cs.umass.edu:3000>

# Our Motivation...

- Senior student in Electrical and Computer Engineering
- Needs to start on her senior project
- Has no research experience
- Having a hard time reading research papers



# Initial Exploration

- Team discussion
- Interviews (8 unstructured, 4 structured)  
(Computer Science, Linguistics, Industrial Engg, ECE @ UMass)
- Recording and Transcripts (for structured)
- Screen recording of graduate students (3x)

# Frustrations with Paper Reading

- Technical jargons
- Scattered information over the internet
- Paper exploration difficulties
- Inconsistent paper formatting

# Objectives

- To develop a collaborative research paper reader that can aid researchers to understand the paper better
- To enable aggregation of annotations which would help researchers gain perspective

# Research Exchange!

# Experiments

- Research group giving feedback on unpublished draft  
*(Naturalistic Setting)*
  - Research group based evaluation ( $n=7$ )
  - Survey based evaluation *(Controlled Setting)*
    - Individual evaluation of the features of the tool  
( $n=7+3$ )

# Population

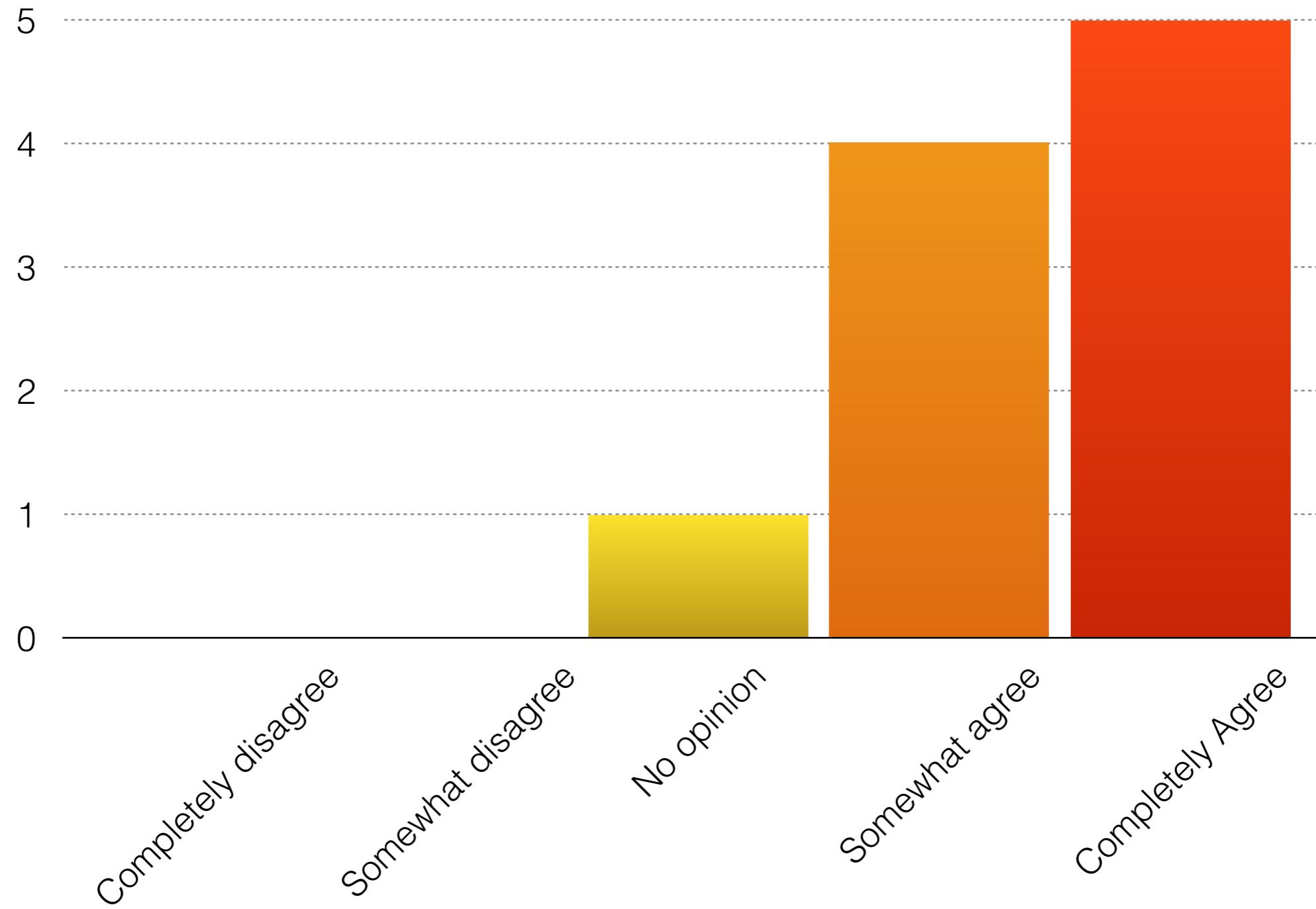
Experience	Description	Count
Experienced researcher	Completed Ph.D. and >4 years of experience	1
Research student	Ph.D. students with 2 to 4 years of experience	3
Beginner research	Undergraduate students with 0-2 years of experience	5

# Emergent Themes

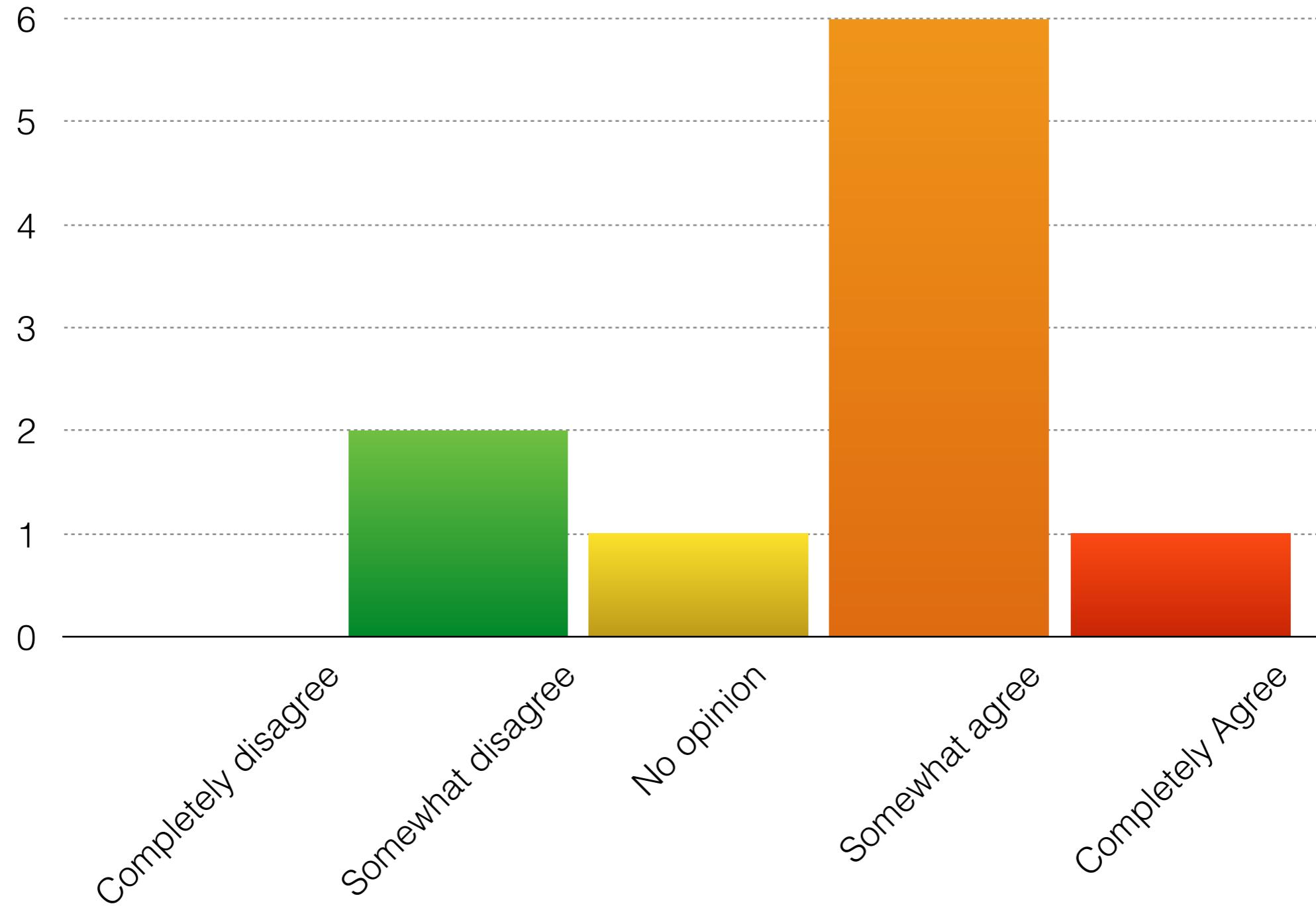
Likes	Dislikes
Appreciate the different color coding of the different annotations	Need help and guidance for a novice user
Space for asking questions within a section	Separation between the paragraphs
Organization-Traversal between the applications	Features like search; export of comments; private annotations

Hypothesis One  
**Annotations lead to better  
understanding of the paper**

# Are the shared annotations useful?



# Are the shared annotations useful?



# Result One: Annotated papers help with understanding

- Results:  $t = -2.3772$ ,  $df = 16.493$ ,  $p\text{-value} = 0.02985$

## Useful Inline Comments

We introduce a new type of deep contextualized word representation that models both (1) complex characteristics of word use (e.g., syntax and semantics), and (2) how these uses vary across linguistic contexts (i.e., to model polysemy). Our word vectors are learned functions of the internal states of a deep bidirectional language model (biLM), which is pretrained on a large text corpus. We show that these representations can be easily added to existing models and significantly improve the state of the art across six challenging NLP problems, including question answering, textual entailment and sentiment analysis. We also present an analysis showing that exposing the deep internals of the pre-trained network is crucial, allowing downstream models to mix different types of semi-supervision signals.

"how these uses vary across linguistic contexts"

What kinds of linguistic contexts?

Kalpesh Krishna, 15:34, 14 April, 2019

1 0

"mix different types of semi-supervision signals"

What does semi-supervised signals mean here?

Kalpesh Krishna, 16:02, 14 April, 2019

0 0

"deep bidirectional language model "

What does bidirectional mean here?

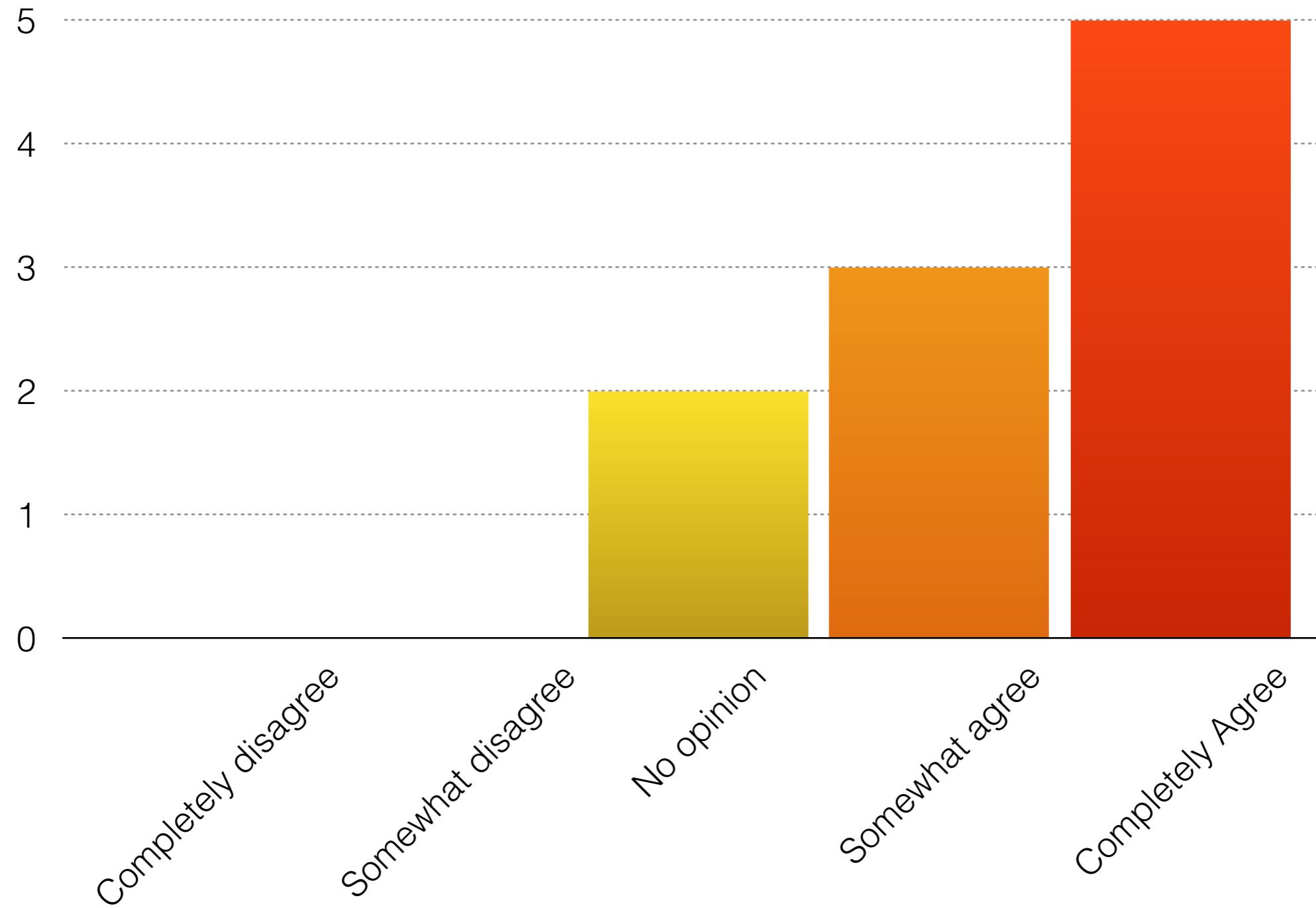
Kalpesh Krishna, 16:08, 14 April, 2019

0 0

**Hypothesis Two**

**Researchers find section level  
annotations better than  
document level annotations**

# Is section level more useful than document level?



# Results Two: Researchers find section view better than document view

- Results:  $t = -3.047$ ,  $df = 15.956$ ,  $p\text{-value} = 0.007706$

**Deep contextualized word representations**  
Matthew E Peters, Mark Neumann, Mohit Iyyer, Matt Gardner, Christopher Clark, Kenton Lee, Luke Zettlemoyer  
NAACL, 2018

**Abstract** = We introduce a new type of deep contextualized word representations that models both (1) complex characteristics of word use (e.g., syntax and semantics), and (2) how words vary across linguistic contexts (i.e., to model polysemy). Our word vectors are learned functions of the internal state of a deep bidirectional language model (biLM), which is pretrained on a large text corpus. We show that these representations outperform existing models and significantly improve the state-of-the-art across six challenging NLP problems, including question answering, natural language inference, and entailment and sentiment analysis. We also present an analysis showing that exposing the deep bidirectional language network is crucial, allowing downstream models to mix different types of semi-supervision signals.



**Comments** **Questions** **Supplementary** **Add Annotation**

This is a great paper!  
*Kalpesh Krishna, 14:35 April 13, 2019* 23  5 

Amazing blog = <http://jalammar.github.io/illustrated-bert/>  
*Kalpesh Krishna, 00:11, 14 April, 2019* 17  0 

This is a great paper!  
*Kalpesh Krishna, 22:35 April 13, 2019* 11  5 

This is a great paper!  
*Kalpesh Krishna, 12:35 April 13, 2019* 8  3  6

**Section View**

*"how these uses vary across linguistic contexts"*

What kinds of linguistic contexts?  
*Kalpesh Krishna, 15:34, 14 April, 2019* 1  0 

*"mix different types of semi-supervised signals"*

What does semi-supervised signals mean here?  
*Kalpesh Krishna, 16:02, 14 April, 2019* 0  0 

*"deep bidirectional language model "*

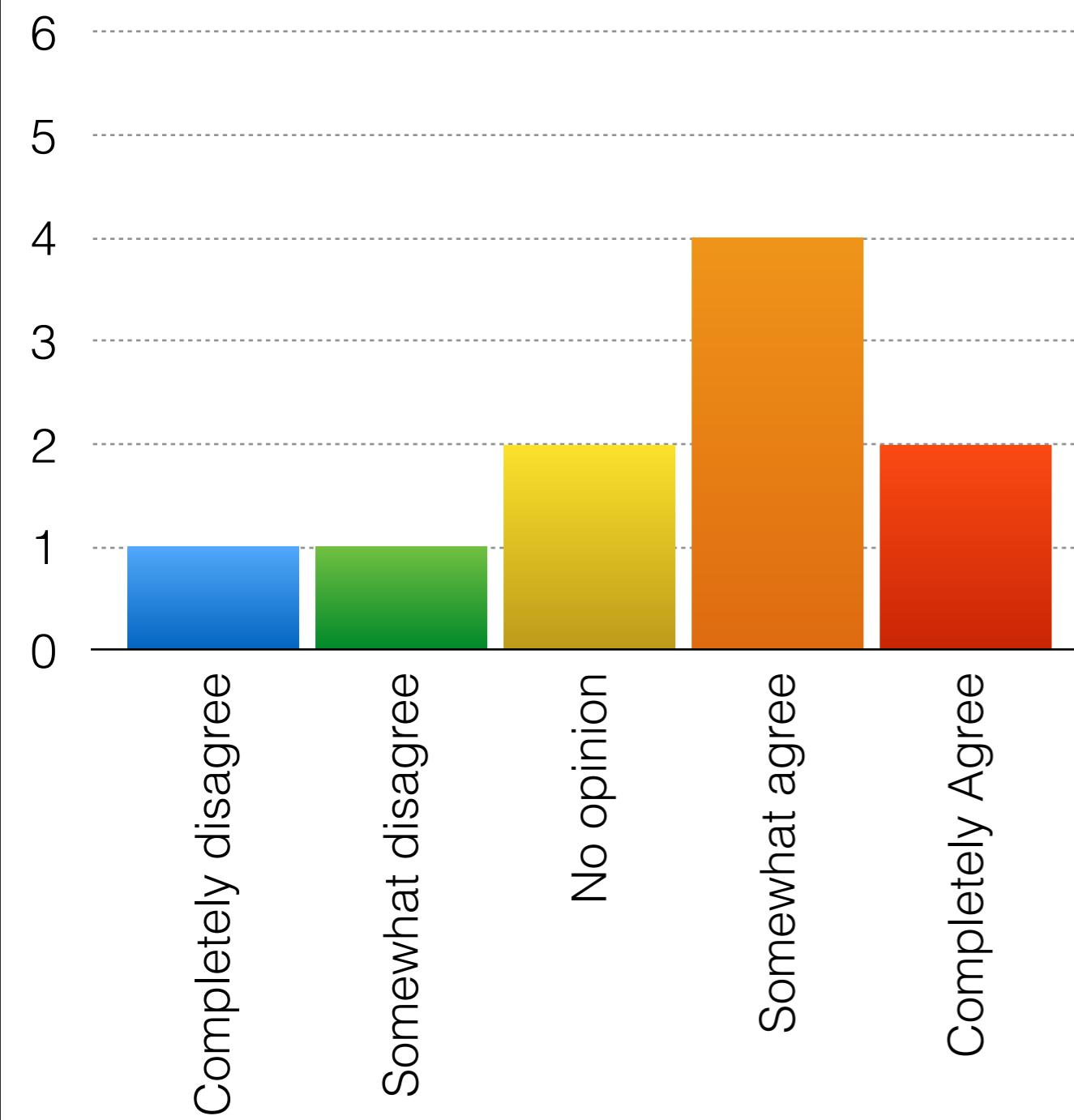
What does bidirectional mean here?  
*Kalpesh Krishna, 16:08, 14 April, 2019* 0  0 

*"semantics), and (2) how these"*

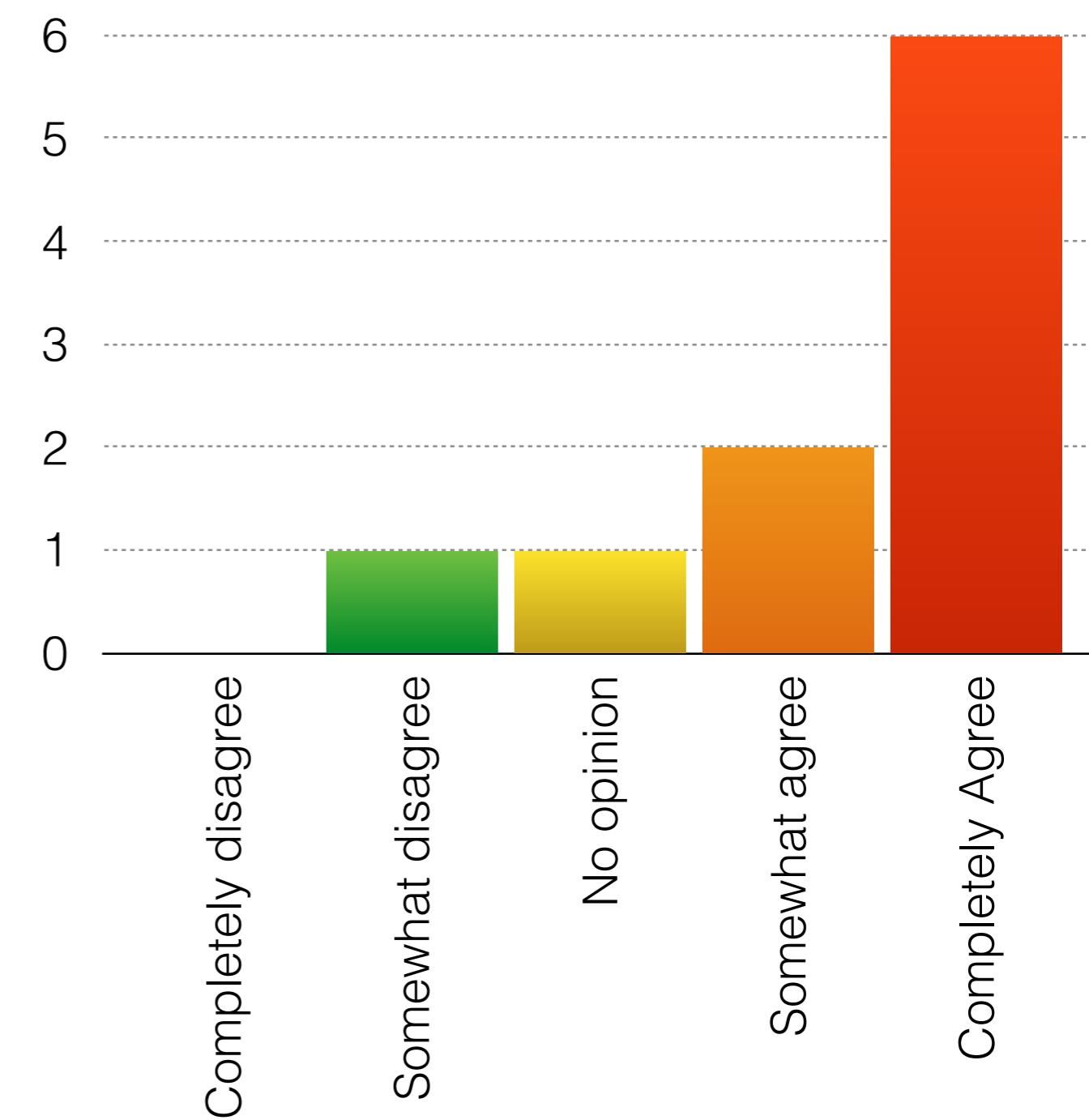
This annotation will mess with things :P  
*Kalpesh Krishna, 16:02, 14 April, 2019*

# Will people share annotations?

Public

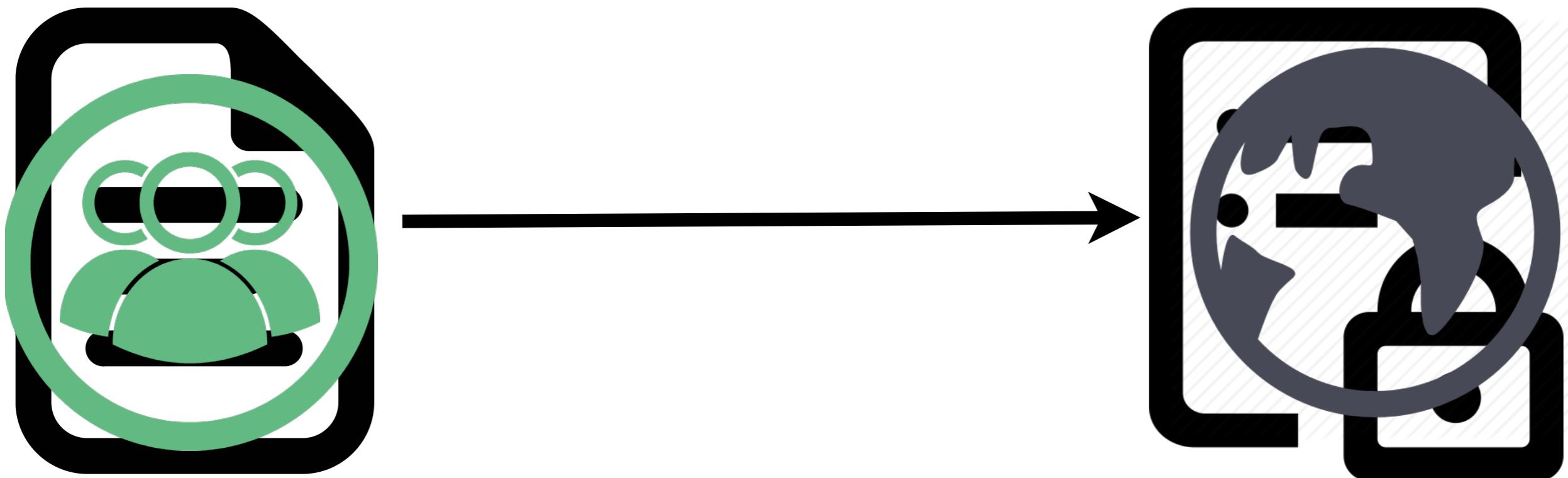


Research Group



# Results Three: Researcher are comfortable share notes within the **research group**

- Results:  $t = 1.5302$ ,  $df = 17.442$ ,  $p\text{-value} = 0.1439$



# Comparison with existing work

Parameter	Notabean	Nurture.ai	Research Exchange
Open Domain / Access	✗	✗	✓
Fine-grained Annotation Types	✗	✗	✓
Textual Highlight Annotations	✗	✓	✓
Segregation of Document / Section Views	✗	✓	✓

# Comparison with existing work

Parameter	Notabean	Nurture.ai	Research Exchange
PDF markup	✓	✓	✗
External Integration	✗	✓	✗
Dialogue Discussions	✓	✓	✗
Is the website fast + working? :)	✓	✗	✓

# Next steps

- **Data Pipelines** - large scale deployment in communities using ParsCit Structured XML
- **Other Features** - like private annotations, use Linux model of user, group, public to change visibility of comments
- **Open Peer Review** - Positive feedback from OpenReview research engineer, discussion later today with team!

# Summary

- Reading research papers is hard, especially for newcomers. We built ResearchExchange!
- Collaborative in-line annotations good solution in some settings (groups, peer-review)
- harder to convince people to add public annotations
- Exciting next steps - large scale deployment, OpenReview